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• Seltz, Helmut, Prof. Dr.
8665 Langenwang (AT)
• Harder, Hans Erich
24253 Probstelerhagen (DE)

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(71) Applicant: Howmedica GmbH
D-24232 Schönkirchen (DE)

(74) Representative:
Graafs, Edo, Dipl.-Ing.
Patentanwälte
Hauck, Graafs, Wehnert, Döring, Siemons et al
Neuer Wall 41
20354 Hamburg (DE)

(72) Inventors:
• Vécsei, Vilmos, Prof. Dr. med.
1140 Vienna (AT)

(54) A device for anchoring a crucial ligament transplant into the knee joint parts

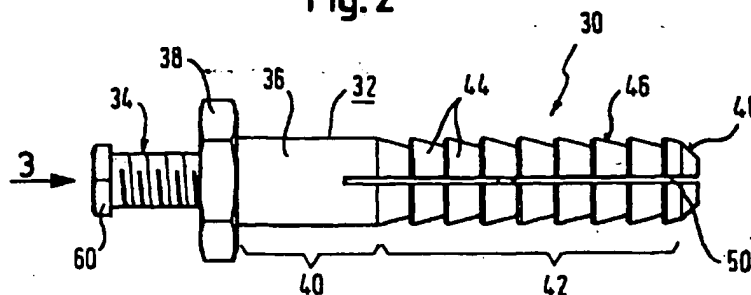
(57) A device for anchoring a crucial ligament transplant in the knee joint parts, characterised by

- a generally cylindrical sleeve (30) of metallic, bio-compatible material, with at least two axis-parallel slots (50) which are distanced in the circumferential direction and which extend from one end over a larger length of the sleeve, with a roughening (42) of a sleeve section in the region of the slots (50), with a head (38) at the other end of the sleeve and with an inner threaded section (56) which extends

from the head up to into the region of the slots, wherein the connecting section (58) of the sleeve bore (54) has a diameter which is equal or smaller than the tip diameter of the inner threaded section, and by

- a screw (34) with a threaded shank (62) which is screwable into the inner thread and with a head (60) at one end of the shank, wherein the length of the shank is smaller than that of the sleeve.

Fig. 2



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Description

[0001] The invention relates to a device for anchoring a crucial ligament transplant into the knee joint parts, according to claim 1.

[0002] It is an established method of knee ligament surgery for a torn crucial ligament, to apply a patella tendon bone transplant. In the first post-operative weeks the intensity of the early functional rehabilitation is limited essentially by the breaking load of the transplant anchoring. It is known to carry out the anchoring with a so-called interference screw. With this the end of the tendon or the bone block connected to the tendon is fixed in a bore of the appropriate knee joint part with the help of a screw. It however has been shown that with this type of fastening problems and complications occur. Thus amongst other things damage to the bone block, uncontrollable displacements of the bone block, fracture of the bone block as well as damage of the ligament transplant take place. Also a erroneous positioning of the interference screw has been observed.

[0003] It is therefore the object of the invention to provide a device for anchoring a crucial ligament transplant which does not have the above disadvantages, can be simply applied and ensures an effective anchoring.

[0004] This object is achieved by the features of claim 1.

[0005] The device according to the invention consists of two parts, specifically a sleeve and a screw. The screw comprises a threaded shank as well as a head on the end of the shank. The sleeve and screw consist of body-compatible material, wherein the sleeve is preferably manufactured of titanium.

[0006] The sleeve comprises a head at one end and at least two axis-parallel slots which are distanced by a circumferential distance and which extend from the other end of the sleeve in the direction of the head. The sleeve comprises further an inner threaded section into which the screw shank is screwed. Since the thread-free sleeve bore section which lies towards the free end of the sleeve in diameter is equal or smaller than the diameter of the inner thread, there is effected a spreading apart of the sleeve at the free end when the screw shank enters into the thread-free part of the sleeve.

[0007] The outer side of the sleeve between the slots is provided with a roughening. With the help of such a device therefore a bone block or the patella tendon itself may be effectively fastened against the walling of a bore which previously has been brought into the joint parts from the outside.

[0008] According to one formation of the invention the roughening is formed by annular ribs concentric to the axis of the sleeve. In cross section the ribs may be formed such that there results a sawtooth-like course which effects a particularly effective anchoring of the transplant in the bore.

[0009] According to one formation of the invention

between the head and the roughening there is provided a smoother outer section for the sleeve. The roughening leads as known to a weakening of the strength of the sleeve. A smooth outer side on the other hand has a higher strength so that the strength of the sleeve as a whole is very high. The slots may extend into the smooth section or end at these. Preferably there are provided four slots arranged at a circumferential distance of 90°.

[0010] According to a further formation of the invention on the outer side of the head of the sleeve there is attached a marking which has a fixed relation to the slots. By way of this the surgeon may ensure that a spread out sector of the sleeve effectively comes into engagement with the transplant. It is avoided that a slot region directly engages with the transplant, which would reduce the effectiveness of the anchoring.

[0011] The head of the sleeve is preferably a polygon as also the head of the screw. The polygon head of the sleeve serves to hold this against rotation when the screw is screwed via its head into the sleeve. It is to be understood that the diameter of the sleeve or the width of the head of the screw is considerably smaller than that of the head of the sleeve.

[0012] According to a further formation of the invention the length of the sleeve is between 26 and 30 mm, preferably 28 mm. The diameter of the sleeve varies between 4 and 6 mm, preferably is 5 mm, measured in the smooth region near to the head or in the tip diameter of the roughening.

[0013] The invention is hereinafter described in more detail by way of an embodiment example shown in the drawings.

Fig. 1 shows two devices according to the invention after their implantation in the knee.

Fig. 2 shows the lateral view of a device according to the invention.

Fig. 3 shows an end view of the device according to Fig. 2 in the direction of arrow 3.

Fig. 4 shows a longitudinal section through the sleeve of the device according to Fig. 2.

Fig. 5 shows the lateral view of a screw of the device according to Fig. 2.

[0014] In Fig. 1 there is indicated a femur 10 and a tibia 12 with the corresponding joint parts 14 and 16 respectively. One recognizes a bore 18 in the joint part 16 and a bore 20 in the joint part 14. They extend outwardly from the femoral and tibial reference point of a somewhat front crucial ligament on the joint part 14 and the joint part 16 respectively. The bores 18, 20 which in each case are carried out from the outside to the inside with the operation, are aligned to one another when the

joints 14, 16 face one another in their position shown in Fig. 1 (stretched knee). Also the outer reference point for the drilling tool on creating the bores 18, 20 is directed according to this.

[0015] In the bores 18, 20 there is located a patella tendon transplant 22, consisting of a tendon section 24 and two bone blocks 26, 28 at the ends of the tendon section 24. The transplant 22 which during the operation is previously removed, is applied into the bores 18, 20 in the manner and way shown in Fig. 1. The fastening of the bone blocks 26, 28 is effected with fastening devices 30 and 32 respectively, which are yet described further below. In this manner the transplant 22 is fastened in the joint parts 14, 16 and may as a result assume the function of a crucial ligament.

[0016] A device according to Fig. 1, for example the device 30, is shown in more detail in the Figures 2 to 5. It is composed of a sleeve 32 of titanium and a screw 34 of a suitable body-compatible material or a suitable metal alloy. The sleeve 32 has a shank 36 and a head 38 at one end. The shank 36 comprises a smooth section 40 which is directly neighbouring the head 38 and which blends into a ribbed section 42. The ribs 44 of the ribbed section 42 are concentric to the longitudinal axis of the shank 36. They are shaped by oblique annular grooves 46 in a manner such that in section there results a sawtooth-like profile. At the end the shank 36 comprises a conical introduction section 48.

[0017] Four axis-parallel slots arranged at a circumferential distance of 90°, of which one is recognized at 50, extend from the introduction section 48 up to in the smooth section 40 and subdivide this section in four sectors.

[0018] As can be recognized from Fig. 3 the head 38 is a hexagonal head whose width is significantly greater than the diameter of the smooth section 40. As can further be recognized from Fig. 3 there are provided four line markings 52 on the head 38, which are arranged at a distance of 90°. The markings lie in each case centrally between neighbouring slots 50. The surgeon who handles the device according to Fig. 2 knows as a result where the sectors in the rotational direction lie in each case.

[0019] As is deduced from Fig. 4, the sleeve 32 and the shank 36 comprises a bore 54 which completely passes through. An inner threaded section 56 extends from the head 38 over approximately two thirds of the shank 36 and then blends into a section 58 with a diameter which corresponds roughly to the tip diameter of the thread.

[0020] In Fig. 5 the screw 34 is represented which comprises a hexagonal head 60 and a threaded shank 62. The threaded shank 62 is shorter than the sleeve shank 36. The head 60 is significantly smaller than the head 38 of the sleeve 32.

[0021] If the screw 34 is screwed into the sleeve 32, the sector sections in the ribbed section 42 spread radially outwards. This condition is shown in Fig. 1. In this

manner the bone blocks 26, 28 are effectively pressed by the sectors against the walling of the bore. It is therefore possible to already prematurely load the transplant, without there existing the danger that the anchoring yields.

[0022] With the treatment firstly after a suitable preparation the bores 18, 20 are shaped into which then the transplant 22 is placed. The diameter of the bore 18, 20 is significantly greater than the thickness of the bone block 26, 28. After positioning the transplant 22 and its temporary fastening with the help of means which here are not shown, from the outside firstly one of the two devices 30, 32 are introduced and actuated with the help of screw tools. The head 38 of the device 30 with a tool is held against rotation so that the screw 34 on the head can be screwed into the sleeve 32 with a simultaneous spreading of the ribbed section 42 for the purpose of pressing the bone blocks 26 or 28 onto the bore wall. If the one bone block 26, 28 is anchored there is then effected the anchoring of the other bone block in the same way.

Claims

1. A device for anchoring a crucial ligament transplant in the knee joint parts, characterised by
 - a generally cylindrical sleeve (30) of metallic, bio-compatible material, with at least two axis-parallel slots (50) which are distanced in the circumferential direction and which extend from one end over a larger length of the sleeve (30), with a roughening (42) of a sleeve section in the region of the slots (50), with a head (38) at the other end of the sleeve (30) and with an inner threaded section (56) which extends from the head (38) up to into the region of the slots (50), wherein the connecting section (58) of the sleeve bore (54) has a diameter which is equal or smaller than the tip diameter of the inner threaded section (56), and by
 - a screw (34) with a threaded shank (62) which is screwable into the inner thread (54) and with a head (60) at one end of the shank (62), wherein the length of the shank (62) is smaller than that of the sleeve (30).
2. A device according to claim 1, characterised in that the sleeve (30) is formed of titanium.
3. A device according to claim 1 or 2, characterised in that the roughening is formed by annular ribs (44) concentric to the axis of the sleeve (30).
4. A device according to claim 3, characterised in that the annular ribs are shaped such that in section there results a sawtooth-like course.

5. A device according to one of the claims 1 to 4, characterised in that the sleeve (30) between the head (38) and the roughening (42) comprises a smooth outer section (40).
6. A device according to claim 1 and 5, characterised in that the slots (50) extend into the smooth section (40).
7. A device according to claims 1 to 6, characterised in that there are provided four slots (50) at a circumferential distance of 90°.
8. A device according to one of claims 1 to 7, characterised in that the head (38, 60) of the sleeve (30) and/or screw (34) is a polygonal head.
9. A device according to one of the claims 1 to 8, characterised in that diameter of the screw head (60) is smaller than that of the sleeve head (38).
10. A device according to one of claims 1 to 9, characterised in that the sleeve (30) has a length of 26 to 30 mm, preferably of about 28 mm.
11. A device according to one of the claims 1 to 10, characterised in that the sleeve has a diameter of 4 to 6 mm, preferably of 5 mm.
12. A device according to one of claims 1 to 11, characterised in that on the outer side of the head (38) there is provided a marking (52) which has a fixed relation to the position of the slot (50).

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Fig. 1

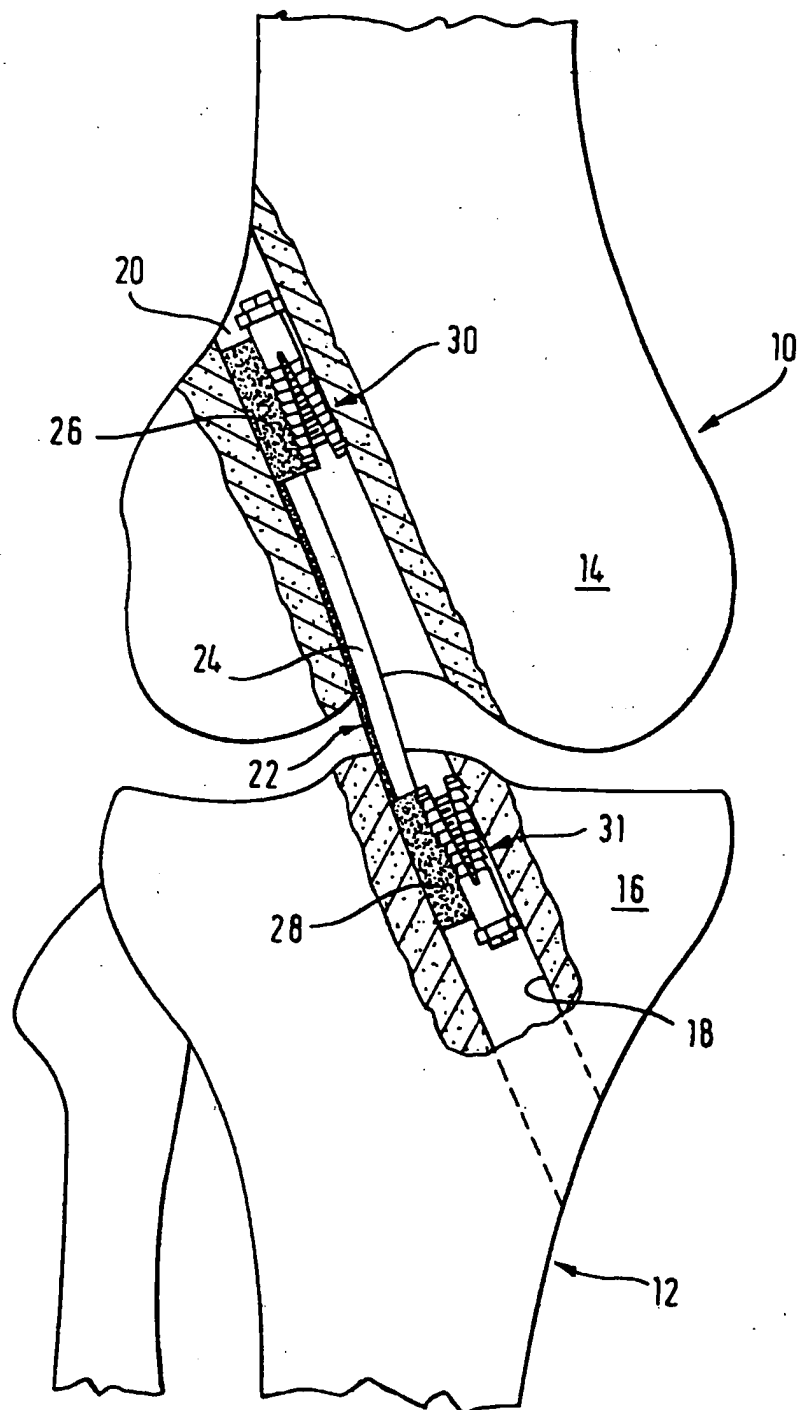


Fig. 2

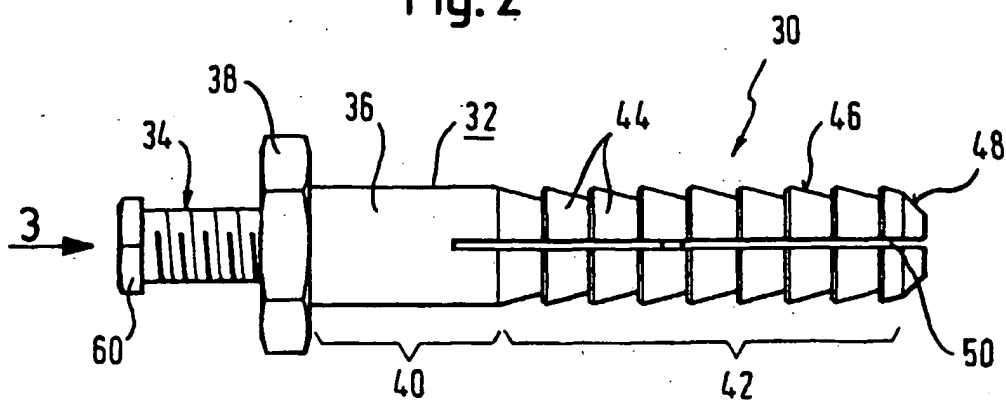


Fig. 3

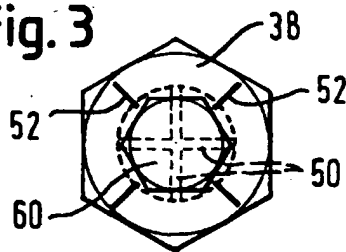


Fig. 4

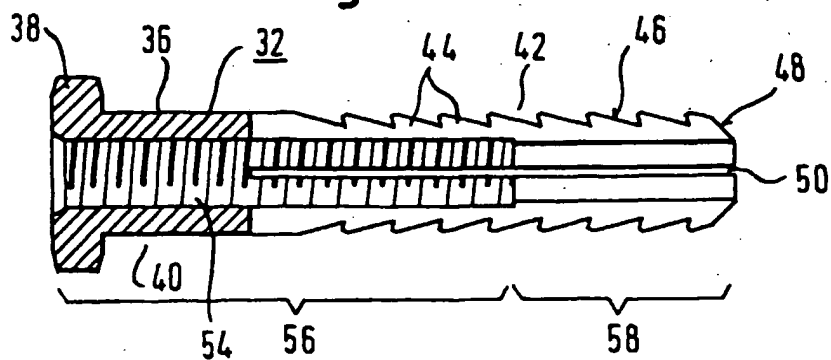
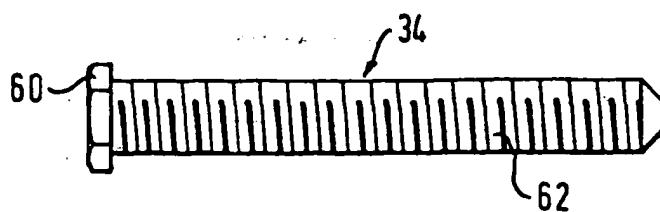


Fig. 5





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EUROPEAN SEARCH REPORT

Application Number
EP 99 11 6209

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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 22 December 1999	Examiner Korth, C-F
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EPO FORM 1503 (03.92) (P04001)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 99 11 6209

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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